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UDC 621·822·6/·8 : 621·753·1 : 001·4

IS : 11027-1984
ISO 1132-1980

(Reaffirmed 2006)

Indian Standard

DEFINITIONS OF TOLERANCES FOR ROLLING BEARINGS

(ISO Title : Rolling Bearings — Tolerances — Definitions)

National Foreword

This Indian Standard, which is identical with ISO 1132-1980 ‘ Rolling bearings — tolerances — definitions ’ issued by the International Organization for Standardization was adopted by the Indian Standards Institution on the recommendation of the Rolling Bearings Sectional Committee and approved by the Engineering Division Council.

In the adopted standard certain terminology and conventions are not identical with those used in Indian Standards; attention is specially drawn to the following :

Comma (,) has been used as a decimal marker while in Indian Standards the current practice is to use full point (.) as the decimal marker.

Wherever the words ‘ International Standard ’ appear, referring to this standard, they should be read as ‘ Indian Standard ’.

Additional Information

This Indian Standard is the national implementation of ISO 1132-1980; as such only the English text has been reproduced. If the French text is required, reference should be made to original ISO publication.

Rolling Bearings Sectional Committee, EDC 39 [Ref : Doc : EDC 39(4336)]

Adopted 10 September 1984	© January 1985, ISI	Gr 3

INDIAN STANDARDS INSTITUTION
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

1 Scope and field of application

This International Standard defines terms used in International Standards specifying tolerances for boundary dimensions, running accuracy and internal clearance for rolling bearings. In addition, it specifies general conditions under which these tolerances apply and gives symbols for a number of the concepts defined.

2 General conditions

At a temperature of + 20 °C, and provided that the bearing parts are completely unstressed by external forces, including measuring loads and the gravitational force on the part itself, a boundary dimension of a bearing or bearing part should not deviate from the nominal dimension by more than the tolerance to be applied.

Only the low deviation of a bore diameter tolerance and the high deviation of an outside diameter tolerance apply to the entire width of the bore and outside surfaces of bearing rings. In other respects, the definitions in clauses 4.1, 4.2 and 4.3 only concern the surfaces between ring chamfers.

Unless there is an indication to the contrary, the terms "ring", "inner ring" and "outer ring" as used in this International Standard, include washer, shaft washer and housing washer, respectively.

3 Axes, directions, planes

3.1 inner ring axis : Axis of the cylinder inscribed in a basically cylindrical bore or of the cone inscribed in a basically tapered bore.

3.2 outer ring axis : Axis of the cylinder circumscribed around a basically cylindrical outside surface.

3.3 bearing axis : Identical to the inner ring axis.

3.4 reference face of a ring : Face so designated by the manufacturer of the bearings and which may be the datum for measurements.

3.5 radial plane : Plane perpendicular to the bearing or ring axis. It is, however, acceptable to consider radial planes referred to in the definitions as being parallel with the plane tangential to the reference face of a ring.

3.6 radial direction : Direction through the bearing or ring axis in a radial plane.

3.7 axial plane : Plane containing the bearing or ring axis.

3.8 axial direction : Direction parallel with the bearing or ring axis. It is, however, acceptable to consider axial directions referred to in the definitions as being perpendicular to the plane tangential to the reference face of a ring or back face of a thrust bearing washer.

3.9 middle of raceway : Point or line on a raceway surface, halfway between the two edges of the raceway.

3.10 raceway contact diameter : Diameter of the theoretical circle through the nominal points of contact between the rolling elements and the raceway.

NOTE — For roller bearings, the nominal point of contact is generally at the middle of the roller.

3.11 cylinder and cone : Cylinder and cone, respectively, circular in sections perpendicular to its axis.

4 Boundary dimensions

Diameter (width) variations and mean diameters (width) defined in this clause, are the differences and arithmetical means of the actual largest and smallest single dimensions, not of the permissible limits for the single dimensions.

4.1 Bore diameter

4.1.1 nominal bore diameter, d : Diameter of the cylinder containing the theoretical bore surface of a cylindrical bore.

Diameter, in a designated radial plane, of the cone containing the theoretical bore surface of a tapered bore.

NOTE — For rolling bearings, the nominal bore diameter is generally the reference value (basic diameter) for deviations of the actual bore surface.

4.1.2 single bore diameter, d_s : Distance between two parallel tangents to the line of intersection of the actual bore surface and a radial plane.

4.1.3 deviation of a single bore diameter, Δ_{ds} (of a basically cylindrical bore) : Difference between a single bore diameter and the nominal bore diameter, $\Delta_{ds} = d_s - d$.

4.1.4 bore diameter variation, V_{ds} (of a basically cylindrical bore) : Difference between the largest and the smallest of the single bore diameters of an individual ring.

4.1.5 mean bore diameter, d_m (of a basically cylindrical bore) : Arithmetical mean of the largest and the smallest of the single bore diameters of an individual ring.

4.1.6 mean bore diameter deviation, Δ_{dm} (of a basically cylindrical bore) : Difference between the mean bore diameter and the nominal bore diameter, $\Delta_{dm} = d_m - d$.

4.1.7 single plane mean bore diameter, d_{mp} : Arithmetical mean of the largest and the smallest of the single bore diameters in a single radial plane.

4.1.8 single plane mean bore diameter deviation, Δ_{dmp} (of a basically cylindrical bore) : Difference between a single plane mean bore diameter and the nominal bore diameter, $\Delta_{dmp} = d_{mp} - d$.

4.1.9 bore diameter variation in a single radial plane, V_{dp} : Difference between the largest and the smallest of the single bore diameters in a single radial plane.

4.1.10 mean bore diameter variation, V_{dmp} (of a basically cylindrical bore) : Difference between the largest and the smallest of the single plane mean bore diameters of an individual ring.

4.2 Outside diameter

4.2.1 nominal outside diameter, D (of a basically cylindrical outside surface) : Diameter of the cylinder containing the theoretical outside surface.

NOTE — For rolling bearings, the nominal outside diameter is generally the reference value (basic diameter) for deviations of the actual outside surface.

4.2.2 single outside diameter, D_s : Distance between two parallel tangents to the line of intersection of the actual outside surface and a radial plane.

4.2.3 deviation of a single outside diameter, Δ_{Ds} (of a basically cylindrical outside surface) : Difference between a single outside diameter and the nominal outside diameter, $\Delta_{Ds} = D_s - D$.

4.2.4 outside diameter variation, V_{Ds} (of a basically cylindrical outside surface) : Difference between the largest and the smallest of the single outside diameters of an individual ring.

4.2.5 mean outside diameter, D_m (of a basically cylindrical outside surface) : Arithmetical mean of the largest and the smallest of the single outside diameters of an individual ring.

4.2.6 mean outside diameter deviation, Δ_{Dm} (of a basically cylindrical outside surface) : Difference between the mean outside diameter and the nominal outside diameter, $\Delta_{Dm} = D_m - D$.

4.2.7 single plane mean outside diameter, D_{mp} : Arithmetical mean of the largest and the smallest of the single outside diameters in a single radial plane.

4.2.8 single plane mean outside diameter deviation, Δ_{Dmp} (of a basically cylindrical outside surface) : Difference between a single plane mean outside diameter and the nominal outside diameter, $\Delta_{Dmp} = D_{mp} - D$.

4.2.9 outside diameter variation in a single radial plane, V_{Dp} : Difference between the largest and the smallest of the single outside diameters in a single radial plane.

4.2.10 mean outside diameter variation, V_{Dmp} (of a basically cylindrical outside surface) : Difference between the largest and the smallest of the single plane mean outside diameters of an individual ring.

4.3 Form

4.3.1 deviation from circular form (of a basically circular line on a surface) : Greatest radial distance between the circle inscribed in the line (inside surface) or circumscribed around the line (outside surface) and any point on the line.

4.3.2 deviation from cylindrical form (of a basically cylindrical surface) : Greatest radial distance, in any radial plane, between the cylinder inscribed in the surface (inside surface) or circumscribed around the surface (outside surface) and any point on the surface.

4.3.3 deviation from spherical form (of a basically spherical surface) : Greatest radial distance, in any equatorial plane, between the sphere inscribed in the surface (inside surface) or circumscribed around the surface (outside surface) and any point on the surface.

4.4 Width and height

4.4.1 nominal ring width, B (inner ring) or C (outer ring) : Distance between the two theoretical side faces of a ring.

NOTE — For rolling bearings, the nominal width is generally the reference value (basic dimension) for deviations of the actual width.

4.4.2 single ring width, B_s or C_s : Distance between the points of intersection of the two actual side faces of a ring and a straight line perpendicular to the plane tangential to the reference face of the ring.

4.4.3 deviation of a single ring width, Δ_{Bs} or Δ_{Cs} : Difference between a single ring width and the nominal ring width, $\Delta_{Bs} = B_s - B$ and $\Delta_{Cs} = C_s - C$.

4.4.4 ring width variation, V_{Bs} or V_{Cs} : Difference between the largest and the smallest of the single widths of an individual ring.

4.4.5 mean ring width, B_m or C_m : Arithmetical mean of the largest and the smallest of the single width of an individual ring.

4.4.6 nominal bearing width, B, C or T (radial bearing) : Distance between the two theoretical ring faces designated to bound the bearing width.

NOTE — The nominal bearing width is generally the reference value (basic dimension) for deviations of the actual bearing width. Symbol B is used where the nominal width is the distance between the inner ring faces, as well as where inner and outer rings are equally wide and their faces nominally flush. Symbol C is used where the nominal width is the distance between the outer ring faces (providing symbol B is not applicable). Symbol T is used where the nominal width is the distance between one inner ring face and the outer ring face on the opposite side.

4.4.7 actual bearing width, T_s (radial bearing where one inner ring face and one outer ring face are designated to bound the bearing width) : Distance between the points of intersection of the bearing axis and the two planes tangential to the actual ring faces designated to bound the bearing width.

NOTE — For a single-row tapered roller bearing this is the distance between the points of intersection of the bearing axis and two planes, one tangential to the actual back face of the cone and one tangential to that of the cup, the cone and cup raceways and the cone back face rib being in contact with all the rollers.

4.4.8 deviation of the actual bearing width, Δ_{Ts} (radial bearings where one inner ring face and one outer ring face are designated to bound the bearing width) : Difference between the actual bearing width and the nominal bearing width, $\Delta_{Ts} = T_s - T$.

4.4.9 nominal bearing height, T (thrust bearing) : Distance between the two theoretical washer back faces designated to bound the bearing height.

NOTE — The nominal bearing height is generally the reference value (basic dimension) for deviations of the actual bearing height.

4.4.10 actual bearing height, T_s (thrust bearing) : Distance between the points of intersection of the bearing axis and the two planes tangential to the actual washer back faces designated to bound the bearing height.

4.4.11 deviation of the actual bearing height, Δ_{Ts} (thrust bearing) : Difference between the actual bearing height and the nominal bearing height, $\Delta_{Ts} = T_s - T$.

4.5 Ring chamfer dimension

4.5.1 nominal chamfer dimension, r : Chamfer dimension value used for reference purposes.

NOTE — Replaced by r_{smin} (see 4.5.3) for reference purposes in International Standards published after 1974.

4.5.2 single chamfer dimension, r_s

— radial dimension : Actual distance, in a single axial plane, from the imaginary sharp ring corner to the intersection of the chamfer surface and the ring face.

— axial dimension : Actual distance, in a single axial plane, from the imaginary sharp ring corner to the intersection of the chamfer surface and the bore or outside surface of the ring.

4.5.3 smallest single chamfer dimension, r_{smin} (minimum limit) : In addition to defining the smallest permissible radial and axial single chamfer dimension, this is the radius of an imaginary circular arc, in an axial plane, tangential to the ring face and the bore or outside surface of the ring, beyond which no ring material is allowed to project.

4.5.4 largest single chamfer dimension, r_{smax} (maximum limit) : The largest permissible radial or axial single chamfer dimension.

5 Running accuracy

5.1 Radial runout

5.1.1 radial runout of assembled bearing inner ring, K_{ia} (radial bearing) : Difference between the largest and the smallest of the radial distances between the bore surface of the inner ring, in different angular positions of this ring, and a point in a fixed position relative to the outer ring. At the angular position of the point mentioned, or on each side and close to it, rolling elements are to be in contact with both the inner and outer ring raceways and (in a tapered roller bearing) the cone back face rib, the bearing parts being otherwise in normal relative positions.

5.1.2 radial runout of assembled bearing outer ring, K_{ea} (radial bearing) : Difference between the largest and the smallest of the radial distances between the outside surface of the outer ring, in different angular positions of this ring, and a point in a fixed position relative to the inner ring. At the angular position of the point mentioned, or on each side and close to it, rolling elements are to be in contact with both the inner and outer ring raceways and (in a tapered roller bearing) the cone back face rib, the bearing parts being otherwise in normal relative positions.

5.2 Face runout with raceway

5.2.1 assembled bearing inner ring face runout with raceway, S_{ia} (groove type radial ball bearing) : Difference between the largest and the smallest of the axial distances between the reference face of the inner ring, in different relative angular positions of this ring, at a radial distance from the inner ring axis equal to half the inner ring raceway contact diameter, and a point in a fixed position relative to the outer ring. The inner and outer ring raceways are to be in contact with all the balls.

5.2.2 assembled bearing cone back face runout with raceway, S_{ia} (tapered roller bearing) : Difference between the largest and the smallest of the axial distances between the cone back face, in different angular positions of the cone, at a radial distance from the cone axis equal to half the cone raceway contact diameter, and a point in a fixed position relative to the cup. The cone and cup raceways and the cone back face rib are to be in contact with all the rollers, the bearing parts being otherwise in normal relative positions.

5.2.3 assembled bearing outer ring face runout with raceway, S_{ea} (groove type radial ball bearing) : Difference between the largest and the smallest of the axial distances between the reference face of the outer ring, in different relative angular positions of this ring, at a radial distance from the outer ring axis equal to half the outer ring raceway contact diameter, and a point in a fixed position relative to the inner ring. The inner and outer ring raceways are to be in contact with all the balls.

5.2.4 assembled bearing cup back face runout with raceway, S_{ea} (tapered roller bearing) : Difference between the largest and the smallest of the axial distances between the cup back face, in different angular positions of the cup, at a radial distance from the cup axis equal to half the cup raceway contact diameter, and a point in a fixed position relative to the cone. The cone and cup raceways and the cone back face rib are to be in contact with all the rollers, the bearing parts being otherwise in normal relative positions.

5.3 Face runout with bore

5.3.1 face runout with bore, S_d (inner ring, reference face) : Difference between the largest and the smallest of the axial distances between a plane perpendicular to the ring axis and the reference face of the ring, at a radial distance from the axis of half the inner ring raceway contact diameter.

5.4 Raceway parallelism with face

5.4.1 raceway parallelism with face, S_i or S_e (inner or outer ring of groove type radial ball bearing, reference face) : Difference between the largest and the smallest of the axial distances between the plane tangential to the reference face and the middle of the raceway.

5.5 Outside surface inclination

5.5.1 variation of outside surface generatrix inclination with face, S_D (outer ring basically cylindrical surface, reference face) : Total variation of the relative position, in a radial direction parallel with the plane tangential to the reference face of the outer ring, of points on the same generatrix of the outside surface at a distance from the side faces of the ring equal to the maximum limit of the axial chamfer dimension.

5.6 Thickness variation

5.6.1 inner ring raceway to bore thickness variation, K_i (radial bearing) : Difference between the largest and the smallest of the radial distances between the bore surface and the middle of a raceway on the outside of the ring.

5.6.2 outer ring raceway to outside surface thickness variation, K_e (radial bearing) : Difference between the largest and the smallest of the radial distances between the outside surface and the middle of a raceway on the inside of the ring.

5.6.3 washer raceway to back face thickness variation, S_i **or** S_e (thrust bearing shaft or housing washer, flat back face) : Difference between the largest and the smallest axial distance between the back face and the middle of a raceway on the opposite side of the washer.

6 Internal clearance

6.1 Radial clearance

6.1.1 radial internal clearance, G_r (bearing capable of taking purely radial load, non-preloaded) : The arithmetical mean of the radial distances through which one of the rings may be displaced relative to the other, from one eccentric extreme position to the diametrically opposite extreme position, in different angular directions and without being subjected to any external load. The mean value includes displacements with the rings in different angular positions relative to each other and with the set of rolling elements in different angular positions in relation to the rings.

NOTE — At each limiting eccentric position of the rings in relation to each other, their relative axial position, and the position of the rolling elements relative to the raceways, are to be such that the one ring has actually assumed the extreme eccentric position in relation to the other ring.

6.1.2 theoretical radial internal clearance (radial contact bearing) : Outer ring raceway diameter minus the inner ring raceway diameter minus twice the rolling element diameter.

NOTE — For a master bearing, i.e. a bearing having negligible form errors, the clearance defined in 6.1.1 is identical to the theoretical clearance, providing that a rolling element is positioned in line with the angular direction of displacement.

6.2 Axial clearance

6.2.1 ***axial internal clearance***, G_a (bearing capable of taking axial load in both directions, non-preloaded) : The arithmetical mean of the axial distances through which one of the rings may be displaced relative to the other, from one axial extreme position to the opposite extreme position, without being subjected to any external load. The mean value includes displacements with the rings in different angular positions relative to each other and with the set of rolling elements in different angular positions in relation to the rings.

NOTE — At each limiting axial position of the rings in relation to each other, their relative radial position, and the position of the rolling elements relative to the raceways, are to be such that the one ring has actually assumed the extreme axial position in relation to the other ring.

Printed at Simco Printing Press, Delhi, India